Technical Analysis of Item 2: Calculation of the lost benefits of lower telecommunications prices in a complete simultaneous equations macroeconomic model

Any analysis of the effects of telecommunications on macroeconomic factors such as "consumer welfare, the economy, and employment" discussed by the Commission in General issue 2 must take into account the dynamic multipliers and interrelationships represented in the typical simultaneous dynamic equations model of the macroeconomy. Furthermore, it must explicitly compare the tradeoff between two fundamental options that face the FCC in the current price cap proceeding: The first option — promoted by the LECs — is to fund telecommunications investment with higher than normal telecommunications rates via a lower than normal "X factor." The second option is to simply lower telecommunications rates by raising the X factor to an appropriate level and thereby provide a large effective decrease in telecommunications rates to business and residential consumers. Obviously both policy options will produce some beneficial economic effects. The critical question for the FCC to address is whether or not the benefits of the (LEC-focused) option 1 are more *or less* than the benefits of the (consumer-focused) option 2.

In order to address this issue directly and provide guidance to the Commission regarding its questions, we adopt the standard economic and econometric approach to modeling complex dynamic interactions in the macroeconomy. The *structure* of the dynamic simultaneous equations model can be written as:[32]

$$y_t \Gamma + x_t B + y_{t-1} \Phi = \varepsilon_t \quad (5)$$

where y_t represents a vector of endogenous variables at time t, x_t represents exogenous variables at time t, and y_{t-1} represents predetermined endogenous variables. These are combined with their coefficient matrices and the usual vector of error terms. The *reduced form* of the model can be written as:

$$y_t = x_t \Pi + y_{t-1} \Delta + v_t \quad (6)$$

where the reduced form coefficient matrices are:

32. The notation presented here is based on that of Greene (1993) *op. cit.* footnote 30 at chapter 20; also see Theil (1971), *op . cit.* footnote 30 at chapter 9.

(7) $$\Pi = - B \cdot \Gamma^{-1}$$

and

(8) $$\Delta = - \Phi \cdot \Gamma^{-1} \quad .$$

The final results that the Commission has requested information on are given by the effects of changes in any of the exogenous variables at time t on each of the endogenous variables both at time t and in later years. This is represented by the *dynamic multiplier* written as:

(9) $$\frac{\partial y_{t,m}}{\partial x_{t-s,k}} = [\Pi \cdot \Delta^{s}]_{k,m}$$

which represent the effects of a change in x at time t-s on y at time t and where k and m index the specific x and y variables of interest. Given an estimated macroeconometric model, equation (9) provides guidance regarding the complex quantitative assessment that the FCC requests.[33]

One way to estimate such dynamic multipliers is to use a small macroeconometric model which is widely respected in the economics profession. The model developed by Nobel prize economist Larry Klein is widely regarded and understood, and it is sufficiently sophisticated to model the dynamics of economic activity. Greene (1993), in his recent comprehensive econometrics textbook, notes that, "This model presents an excellent example of a small, dynamic model of the economy."[34]

The equations of the Klein Model I are:

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33. The short time frame of the existence of price caps presents serious difficulties which indicate that the Commission should proceed with caution in the interpretation of any quantitative study submitted on this issue. Notwithstanding this problem, we provide the best available guidance to the Commission in a widely accepted macroeconometric framework.

34. Greene (1993) *op. cit.*, footnote 30 at 582.

(10) $$C_t = \alpha_0 P_t + \alpha_2 P_{t-1} + \alpha_3 [W_t^p + W_t^g] + \varepsilon_{1t}$$

(11) $$I_t = \beta_0 + \beta_1 P_t + \beta_2 P_{t-1} + \beta_3 K_{t-1} + \varepsilon_{2t}$$

(12) $$W_t^p = \gamma_0 + \gamma_1 X_t + \gamma_2 X_{t-1} + \gamma_3 A_t + \varepsilon_{3t}$$

(13) $$X_t = C_t + I_t + G_t$$

(14) $$P_t = X_t - T_t - W_t^p$$

(15) $$K_t = K_{t-1} + I_t$$

where equation (10) represents the consumption function, equation (11) represents the investment function, equation (12) represents the demand for labor equation, equation (13) is the aggregate output identity, equation (14) is the definition of profits, and equation (15) is the definition of the capital stock. The exogenous variables are government wage spending (W^g), government non-wage spending (G), taxes (T), and a linear time trend (A).

Using the estimates provided in Greene (1993), we can calculate the effects of an increase in LEC spending that is financed with an implicit tax on consumers representing the additional rates charged solely for the purpose of improving the infrastructure.[35] These higher rates are implemented as an X factor below that which would apply based solely upon achievable productivity growth and the effects of incentive regulation. The results of the dynamic multipliers, as calculated from equation (9), are shown in Table 4 for a 5-year time period.[36]

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35. *Id.* at 615.

36. We adopt a five year horizon for the evaluation of the effects of the program. Although one could use a longer time frame, the objective of government policy in this instance should be to produce some near term benefit.

These multipliers can be interpreted as follows. A one-billion dollar increase in government spending funded by a one-billion dollar increase in taxes has a cumulative negative 3.93-billion dollar tax effect after five years, contrasted with a cumulative positive 3.41-billion effect after five years.[37] Thus, the eventual outcome of the tax increase to fund government spending has a net negative effect on the output of the macroeconomy after five years.[38] Thus, according to our analysis based on Klein's dynamic macroeconometric model, if a government-sponsored program resulted in higher than normal telecommunications rates via an X factor 1 percentage point lower than normal and spent it on telecommunications investment projects, the net effect on the macroeconomy after five years would be a net loss of the order of one-half billion dollars.[39]

Table 4

Dynamic Multipliers
Klein's Model I

	Effect of Taxes on Output		Effect of Govt Spending on Output	
Lag	Value	Cum.	Value	Cum.
0	-1.30	-1.30	1.82	1.82
1	-1.74	-3.04	1.06	2.88
2	-1.27	-4.31	1.01	3.89
3	-.502	-4.81	.334	4.22
4	.198	-4.61	-.225	4.00
5	.682	-3.93	-.590	3.41

Source: W. Greene, *Economic Analysis*, Second Edition. New York: MacMillan, 1993, at 622. Note that only 5 years of data are shown here. The complete 20 year data table is provided in Greene (1993).

37. The particular scale of 1934 constant dollars used in the Klein Model I does not affect the results presented and discussed in this section.

38. It is true that Greene (1993) reports a net effect of zero after 20 years; however this is far too long a time period for the evaluation of the type of government policy at issue in this price cap docket. Even at that 20 year period, the net of the increase in telecommunications prices to fund additional telecommunications investment has absolutely no net benefit to the national economy.

39. This analysis assumes that every cent of the additional funds collected through the use of an understated X factor are in fact reinvested into infrastructure by the LECs. Should less than the full amount be reinvested, the offsetting gain would be even smaller. In our discussion of Baseline issue 3 below, we demonstrate that the Regional Bells have not been reinvesting their BOC earnings in the local exchange infrastructure, but have instead been diverting these earnings — and even cash flow generated through depreciation charges made against regulated services — in *non-BOC* business ventures, some of which are outside of the United States.

Therefore, evidence from a widely recognized and highly-regarded macroeconometric model shows clearly that the policy of maintaining a lower than normal X factor for the express purpose of increasing telecommunications investment has no immediate measurable beneficial effect on the macroeconomy when the true simultaneous nature of economic relationships are taken into account. In sum, it amounts to taking money from residential and business consumers now to provide uncertain abstract benefits in the future. These decisions are best left to the marketplace rather than to overt government initiative.

Baseline Issue 1: Infrastructure Development

Baseline Issue 1a: Whether, and if so how, the Commission should revise the LEC price cap plan to support the development of a ubiquitous national information infrastructure.

Baseline Issue 1b: Whether the goal of providing universal service to all geographic areas and of equal type and quality for all Americans at affordable prices being met, or whether we should revise the LEC price cap plan to ensure the provision of universal service.

The Price Cap form of regulation should not be used as a tool of industrial policy.

There are several steps that the FCC can take to "guide LEC investment and other decisions" to stimulate deployment of a ubiquitous advanced telecommunications infrastructure. The majority of these measures properly fall outside of the price cap regime, and include important policy initiatives that the FCC has already undertaken.[40] As discussed below, a few measures, chiefly in the area of monitoring of LECs' investments and deployment practices, could be incorporated into the price cap system.[41] However, it would be a serious error and misuse of the price cap regime to modify the existing price cap, sharing mechanism, depreciation policies, or other regulations bearing on the LECs' financial conditions in order to create additional *financial incentives* for accelerated LEC deployment of facilities underlying the "local links" of the national information infrastructure. Similarly, it would be a grave error to prescribe targets for the deployment by price cap LECs of specific technologies into the local infrastructure, such as penetration of optical fiber facilities into the local loop.

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40. The most important of these initiatives has been to create conditions more conducive to competitive entry in those sectors of the interstate telecommunications market where it is feasible. The FCC's initiatives with respect to the restructuring of local transport pricing, collocation for special and switched access, and 800 database, are the types of actions that need to take place to increase the competitiveness of the local infrastructure.

41. As discussed in response to Issue 3b, the Committee has serious concerns regarding the RBHCs' use of the enormous cash flow they have enjoyed from their operating companies, a minuscule fraction of which — approximately 5% — is being reinvested in the network. *Infra.*, at 66 to 67. The Commission should devote far more attention to monitoring and evaluating the LECs' *current* network investment levels and practices than to devising mechanisms to generate more LEC revenues that may never be used for network development.

As observed in our response to General Issue 1, the essential goal of the LEC price cap plan is to achieve as closely as possible the "competitive result," i.e., the price levels and efficient resource allocations characteristic of fully competitive markets, in those interstate access markets where the LECs continue to wield substantial market power. The reason that economic regulation i.e., price cap, is being applied to the LECs' interstate services at all is that these companies' pricing policies and capital deployments are not sufficiently disciplined by marketplace forces to result in efficient, desirable market outcomes. While price caps is at least intended to limit the exposure of ratepayers and in so doing make the LECs more accountable for the financial consequences of their managerial decisions, including network investment decisions, the reality is that the price cap mechanism falls far short of the discipline imposed by the capital-rationing process that occurs in the private, unregulated sectors of the economy.

Private, unregulated firms compete for capital in the debt and equity markets, and capital is expected to flow to those activities that are willing to pay the most for it, reflecting the particular uses that produce the greatest overall value to the economy as a whole. Investors and providers of financial capital are expected to assume the various *risks* attendant to any economic venture, to factor such risks into their investment decisions, and to be prepared to accept the loss of some or even all of their capital in exchange for the *opportunity* to realize potentially large gains if the activity is successful.

This matching of risks and potential gains does not fully occur under any form of economic regulation of public utilities, including price cap. In the case of the LEC price cap system, the presence of the low-end earnings adjustment device, plus the carriers' constitutional protection from confiscatory rate setting by virtue of their status as regulated utilities, ensures that *ultimately the financial risk of the LECs' technology deployments are borne by the consumers of regulated services*, and not by the LECs or their shareholders who are nevertheless in a position to capture the majority of any financial gains.[42]

This (i.e, the financial risk to ratepayers) is an unavoidable consequence of the fact that the LECs continue to have monopoly power in their principal markets, i.e. basic local service, intraLATA toll, and intrastate and interstate access services: In such cases of demonstrable market failure, regulators must intervene and some centralized decision-making must occur. However, as the evolution of the FCC's competitive entry policies for telecommunications

42. The risk exists today that the price cap mechanism is resulting in inappropriate investments and/or improperly transferring funds out of the BOCs to the RBHCs, etc. (see Issue 3b) This risk would be greatly magnified by creating conditions under which the LECs would have the ability to expand into emerging information markets using funds generated by the price cap mechanism.

acknowledges,[43] the extent (if not the power) of the LEC's monopoly has been shrinking over the past few decades, and the evidence does *not* suggest that deployment of the bulk of the local facilities underlying a national information infrastructure must or even should be included within the sphere of the LECs' regulated, monopoly activities. In fact, an open, competitive marketplace is the best means to realize an optimum development of that infrastructure.

If the price cap regime is modified so as to create any sort of positive, stimulative linkage between the financial constraints of the price cap and the LECs' deployment of advanced network technologies, *the FCC would in effect be creating an industrial policy that will take the nation down the road of centralized, monopolistic development of the national information infrastructure.* However, this approach is neither an inevitability (as the BOCs may tend to portray it), nor is it sound economics. There are, in fact, three choices for development of the national information infrastructure:

(a) The nation's telecommunications and information resources could be developed and acquired through private, risk-taking, entrepreneurial investment made in response to known or anticipated market demand and willingness-to-pay, with issues such as the proper level of investment, the selection among competing technologies and service delivery paradigms, being left entirely to marketplace forces.

(b) The nation's telecommunications infrastructure could be developed as a natural monopoly by the existing dominant local telephone utilities who already possess a ubiquitous infrastructure with near-universal (voice-grade) connectivity, expertise and experience building and managing large networks, expending massive amounts of capital, and a base of monopoly services capable of supplying a baseline level of revenues to financially underwrite and underpin new large-scale construction programs. Alternatively, the responsibility for the development of a new broadband infrastructure could be conferred on the existing cable television operators, who already possess extensive broadband distribution facilities and who, like the local exchange telephone utilities, also have the experience and expertise to construct and manage large ubiquitous networks.

(c) The nation's telecommunications infrastructure could be built and managed by public authorities and other governmental and quasi-governmental bodies, much like the nation's network of public highways, airports, postal service, mass transit systems, and the telecommunications resources of most other countries.

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43. For example, in the initial decision to require LECs to make available the collocation of competitor's access facilities, the Commission concluded that "[t]he growth in competition resulting from expanded interconnection should increase LEC incentives for efficiency and encourage LECs to deploy new technologies facilitating innovative service offerings." CC Docket 91-141, *Report and Order and Notice of Proposed Rulemaking*, 7 FCC Rcd 7380 (1992).

While some limited combination of these alternatives may be possible, for the most part adoption of any one of them will largely preclude the others from occurring, except perhaps in specialized, niche market situations. For example, it would clearly be counterproductive to attempt to have government-owned or managed entities in direct competition with private firms for provision of advanced telecommunications services. As discussed at length below, granting the franchised monopoly carriers, in this case the LECs, a leading role in development of the national information infrastructure *that is backed by the funds received from their regulated, non-competitive services* — as any affirmative linkage to the price caps system would do — is incompatible with the private risk-capital, entrepreneurial approach. And finally, commitment to the latter approach will necessarily mean that the dominant LECs' entry into advanced telecommunications markets will need to be carefully circumscribed and monitored.

In fact, there appears to be little support for pursuing alternative (c) — government-financed construction and government ownership and management — as a general matter, since direct government participation in any particular area of economic activity is not warranted if the private sector is capable of satisfying the public's needs. In many important respects, however, there is little difference between alternative (c) and alternative (b) (the "natural monopoly" model), because in both cases the decisionmaking is centralized in monolithic bureaucracies and the investment risk is ultimately borne by the public; the distinction between the "government" and the "public utility" model is that in the former the resource is built and managed by a public agency, whereas in the latter it is built and managed by a private entity operating under a franchise granted by a public agency under which, among other things, the private investors' capital is fully protected against loss by a guarantee of government action. Experience has taught that private profit-oriented management usually does a better job than public administration of a business activity, so in general the public utility model is clearly preferable to the public ownership approach. However, with respect to the efficacy of resource allocation, and potential for competition and innovation, there is little basis upon which to choose between a government or franchised monopoly provider, since either performs far less well than do private firms in an open, competitive marketplace.

In a market economy, use of private risk capital and market-based decision making is always the preferred method of efficiently allocating society's resources, except under very special circumstances. Policies that encourage — or even mandate — centralized monopolistic development (by private or public entities) of a future telecommunications infrastructure could be justified if and only if one or both of the following economic conditions hold true:

(1) There are sufficiently great economies of scale and/or scope that the static efficiency gains from "natural monopoly" treatment outweigh both the dynamic gains available through innovation and competition as well as the societal risks of centralized, non-market-based investment decisions; *or*

(2) There is not sufficient private risk capital available to finance the investments required. This may occur when (a) the scale of the investment is very large; (b) the risks are unacceptably high to private investors; or (c) an insufficient amount of the potential benefits flowing from the investments would be reflected in market prices; i.e., there is a significant positive "externality" that can only be realized through collective, rather than individual, consumption decisions.

As demonstrated below, neither of these economic conditions apply to the development of the American information infrastructure in the current era. Despite the persistence of the local telephone companies' virtual monopolies in certain traditional segments[44] of the local telecommunications market today, the characteristics of advanced telecommunications technologies and applications make them unsuitable for "natural monopoly" treatment.

Moreover, the accelerating pace of private investment in telecommunications today belies any claims that the desired infrastructure will not develop without additional financial inducements to the nation's local telephone companies, whether through the price cap mechanism or other means. There can be little doubt that a competitive market structure is the preferred paradigm for building a national information infrastructure, and the Commission should assure that its policies and regulatory strategies are fully consistent with this result.

The potential gains from a "natural monopoly" approach to development of the infrastructure — whether via financial inducements to the price cap LECs or other means — fall far short of the benefits achievable through continued innovation, competition, and private investment in telecommunications.

In order for a "natural monopoly" approach to the development of an advanced telecommunications infrastructure to succeed, two conditions would have to be met. First, the underlying technology would have to be sufficiently stable, and second, the market demand sufficiently predictable, that the gains from the "static" efficiencies of natural monopoly (i.e., economies of scale and scope) would exceed the risks of locking in a specific technological direction for an extended length of time or of fundamentally misjudging the potential demand for the services to be provided by these new resources.

However, no one could seriously argue that the technology that will support a national information infrastructure has been definitively established. The single most prominent feature of modern telecommunications technology is the profusion of *multiple, rival*

44. These include local exchange access, local network transport and usage, intraLATA toll, and local ("loop") distribution.

technologies, rather than a convergence on a single technological mode. The copper wire and electromechanical/analog-based architecture that supported telephony for decades has given way to a mix of copper, optical fiber, coaxial cable, satellite, microwave, and other wireless transmission media. The evolutionary cycle of switching machines has been shortened substantially with every new generation of technology (see Figure 1); a completely new technology of "photonic" switching is under development and may begin to supplant electrical switching within the next ten to fifteen years.[45] But while the common attribute of virtually all competing technology systems is *digital*, the solutions each offers vary considerably. So-called "last mile" access can be provided by twisted pair copper wire (as it is today for most telephone access connections), by coaxial cables (the approach being used by most US cable TV companies), by any of several wireless technologies, or by fiber optic cables. Moreover, there is increasing interest in combining various media and digital techniques; for example, research is being conducted on the use of CDMA (code division multiple access) on the return channel in hybrid fiber/coaxial cable systems.[46]

Even the baseline requirement for "broadband" network transmission and switching is competing with solutions that compress large amounts of data or other signals onto narrowband transmission facilities. As recently as about 1980, most public switched network data transmission was limited to 300 bits-per-second (bps) transmission speeds of the (then available) modems. Today, by using 28.8 kbps modems with data compression, transmission speeds of up to 115.2 kbps can be achieved over the same "dial-up" public network services. Thus, without any increase in the underlying transmission and switching bandwidth, effective data transmission rates have been increased by some 384 times the 300 bps limit of 15 years ago. These developments are continuing to greatly expand the quantity of information that can be transmitted without recourse to fiber loop facilities.[47] As with the proliferation of technologies in the underlying physical media, an increasing number of alternative compression techniques are being developed that could be employed in commercial

45. See, e.g., "Fiber Optic Networks: And Then There Was Light," *Communications News*, December 1990, at 13-15; J. Dupraz et. al., "The Future of Photonic Switching," *Electrical Communication*, 4th quarter 1992, at 72-77.

46. "Can CDMA work its magic for cable?" *Telephony*, January 24, 1994, at 16.

47. See, for example, "Compression helps copper equal fiber," *Telephony*, January 31, 1994, which describes a new technique jointly developed by Stevens Institute of Technology and Digital Compression Technology that can expand effective transmission capacity by an additional sixteen times.

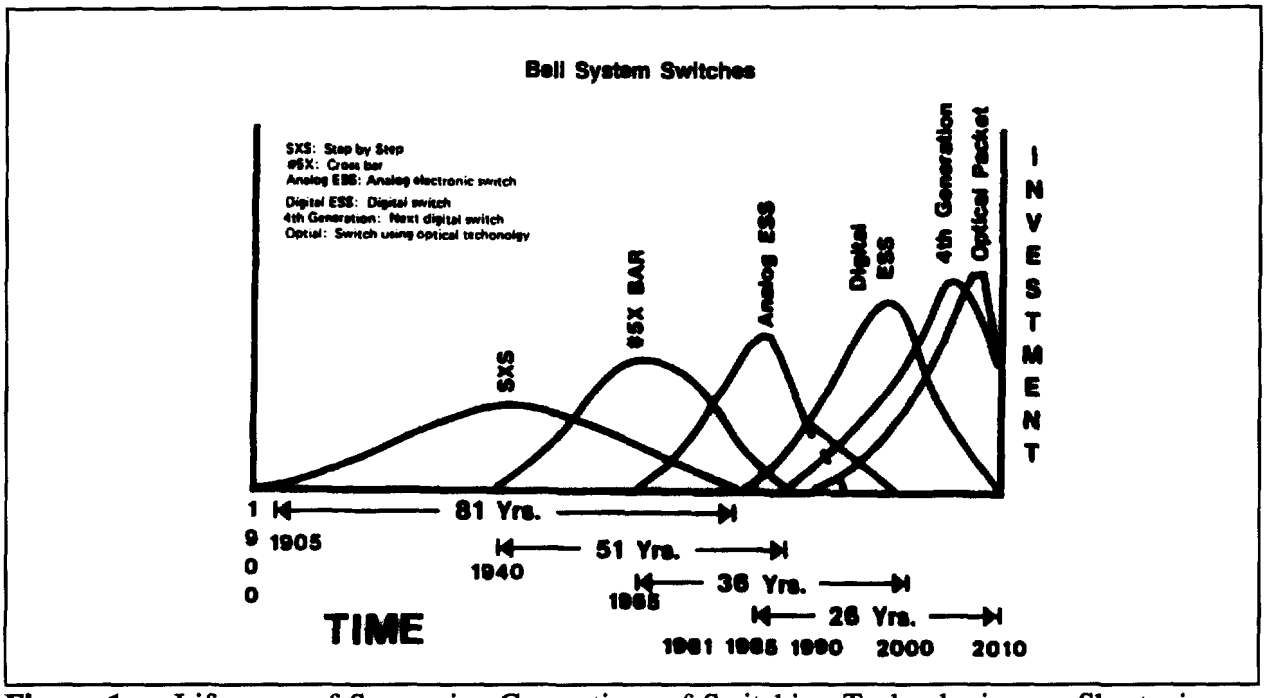

Figure 1 — Lifespans of Successive Generations of Switching Technologies are Shortening
Source: Hyman, L.S. et. al., *The New Telecommunications Industry*, Vol. 1 (1987) at 42.

applications either singly or in combination.[48]

Choosing the "natural monopoly" approach to development of the national information infrastructure — which would be the effect of grafting financial incentives for such development onto the LEC price cap regulatory regime — would create serious roadblocks to the testing of the viability of these technologies in the marketplace, and more generally would hinder the development of the overall telecommunications infrastructure. The economics literature on the relationships between market structure and technology innovation strongly confirms that the commercial gains from technology investment and innovation tend to be significantly less in monopolistic markets compared to those in which competition has been

48. A recent trade press article remarks on "the astounding advances made in signal compression," and cites ADSL/HDSL (already being used by many LECs), MPEG 2 (a predictive algorithm for video), QAM and VSB (alternative video compression techniques), and the Digital Compression Technology/SIT technique referred to earlier. "Compression: Making thin pipes fat," *Telephony*, March 14, 1994, at 18.

allowed to develop.[49]

Consider, for example, the market for telephone handsets and other customer premises equipment (CPE). The *de facto* national policy (as set by the Bell System and acceded to by regulators) for many years was that CPE should be designed and provided through the centralized monopoly apparatus of the Bell System, and for many years the CPE market experienced only slow, incremental progress and relatively little innovation.[50] After CPE was deregulated and the Bell monopoly rolled back, vigorous competition in the CPE market set off an explosion of new equipment designs, styles, and functions that has vastly expanded the range and usefulness of CPE.[51]

As the example of the CPE market vividly demonstrates, a competitive marketplace tends to be far more customer-oriented than a noncompetitive one. Since a large part of the uncertainty surrounding advanced telecommunications services is precisely what customers will want (and will be willing to pay for), it is particularly critical to the development of these services that competitive conditions be extended as far as possible. Only in those circumstances where it is clearly evident that there is unfulfilled customer demand (market failure) should the government (FCC) intervene to "fill the gap."

Moreover, the retarded rate at which innovative commercial applications occur in a monopoly market structure follows directly from the monopolist's profit-maximizing strategy: As explained by the economic authority on the issue (F. M. Scherer), "...the enterprise that anticipates a continuing exogenous technology push will not commence development at the moment when an innovation first becomes profitable but *it will wait until it can expect above-normal economic profits.* Such a strategy of delay is feasible only if the firm has an insulated monopoly position."[52] Withholding technology in this way is a very real concern in the context of LECs' involvement in advanced telecommunications services, and in fact there is at

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49. *See*, e.g., Tirole, Jean. *The theory of Industrial Organization*, MIT Press, 1990, Chapter 10; Scherer, F. M. *Industrial Market Structure and Economic Performance*, Houghton Mifflin Co., Boston, 1990, Chapter 17; and Scherer, F. M. *Innovation and Growth: Schumpeterian Perspectives*, MIT Press, 1984.

50. In fact, the black, rotary dial telephone was a hallmark of the Bell System monopoly for decades.

51. It should not be forgotten that it took some *sixteen years* for full CPE competition to develop, between the initial *Carterphone* ruling in 1968 until the open marketplace established following CPE deregulation and the Bell System divestiture in 1984. Clearly, the nation cannot afford to wait two decades for a mature national information infrastructure to arrive.

52. Scherer, *op.cit.*, footnote 49 [emphasis supplied].

least one local network technology for which commercial roll-out has been delayed in precisely the fashion predicted by the theory.

Since the mid-1980s, ISDN (integrated services digital network) has been a viable technology for providing relatively low-cost digital connectivity on a wide-spread basis, but it has received comparatively little support by the LECs as they pursue the strategic objective of ubiquitous broadband networks. For example, while Pacific Bell specifically identified ISDN as a benefit of its accelerated plant modernization program as early as December of 1987,[53] Bell did not submit a tariff for "Basic Rate" ISDN in California until February 19, 1993, *some five years later.*[54] Similarly, Southwestern Bell has had the capability to deploy ISDN on a customer-specific basis since at least June of 1986,[55] but will have deployed ISDN on only 21% of its access lines by the end of this year.[56] In other states, ISDN has been made available somewhat sooner, but at prohibitively expensive "market-based" rates that have chilled consumer interest in the service and impeded its use by enhanced services providers as a cost-effective means to reach their customer base.[57]

The potential demand for next-generation telecommunications services is nowhere near predictable enough to warrant any price cap linkages that could result in the expenditure of ratepayer-backed funds on the technologies to provide them.

The second requirement for successful sectoral development through an industrial policy of centralized, monopoly development is that demand must be relatively predictable. This condition also fails to hold relative to the services that an advanced information infrastructure would make possible. The speculative nature of the new applications and markets loosely

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53. Pacific Bell Depreciation Study (December 1987), Section I at 17 and 21.

54. Pacific Bell Proposed Schedule CAL. P.U.C. No. A5, §5.4.1, dated February 19, 1993, Advice Letter No. 16469.

55. "SW Bell dives into ISDN with largest cutover to date," *Telephony*, June 13, 1998, at 10.

56. *The EFF Open Platform Proposal* (Electronic Frontier Foundation, Inc., July 1992) at 11, footnote 97, citing *ISDN Deployment Data* (BellCore Report SR-NWR-002102, Issue 2, June 1992).

57. The founder of Lotus Development Corporation has testified that "there are substantial and vastly underappreciated entrepreneurial opportunities which would arise out of the widespread availability of ISDN at affordable prices." *Testimony of Mitch Kapor*, May 16, 1991, "NET-ISDN," Massachusetts D.P.U. Docket No. 91-63.

referred to as the "information superhighway" cannot be overemphasized. Quoting the head of the nation's largest cable television company, *The Economist* makes the point succinctly with respect to broadband "multimedia" services:

> Can multimedia pay its way? The first problem, as John Malone, TCI's chairman, concedes, is that most of the revenues from multimedia will be generated *by products* — such as interactive television and programming for hundreds of multimedia channels — *that do not yet exist.*[58]

There is a huge gap between the types of services that an advanced digital infrastructure could provide as a *technical* matter, and the actual types of applications that will be sufficiently cost-effective, useful, and attractive to consumers to result in a commercially-successful product. This disparity has led at least one prominent telecommunications researcher to flatly declare that:

> [w]e cannot solve the problem of forecasting the demand for the new services that IBNs [integrated broadband networks] will make possible. It is impossible to predict with any confidence that the demand will be sufficient (however defined) to make such an infrastructure economically viable; it is also impossible to predict that it will not be sufficient.[59]

Moreover, many of the demand projections that have been made for specific "information age" applications do not stand up to even casual scrutiny. The demand estimates cited by the BOCs and other local exchange carriers in particular often ignore the existence or likely development of competitive alternatives. For example, Pacific Bell recently announced plans for a pilot project to test the use of broadband fiber optic transmission for the distribution of motion picture films to movie theaters in California.[60] Pacific, in making its announcement, noted that the motion picture industry currently spends some $300-million annually to

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58. *The Economist*, December 4, 1993, at 67 [emphasis supplied].

59. Martin C. J. Elton, "Forecasting the Demand for New Broadband Services," in *Integrated Broadband Networks: The Public Policy Issues*, Martin C. J. Elton, ed., 1991. Martin (a past Director of the Center for Telecommunications and Information Studies at Columbia Business School) has concluded that development of a broadband infrastructure should proceed in an evolutionary and market-based manner in order to minimize the societal risks of massive failed investments. See *id.*, at 63-65.

60. "PacBell to Test Digitized Movie Transmissions," *Wall Street Journal*, March 21, 1994, at A-16.

distribute prints of films to theaters across the country.[61] First, there is some question as to whether video display technology has even advanced to the point where it can match the quality, clarity and brightness achievable through conventional film projection, even at the $100,000 price level for contemporary video projection equipment suitable for commercial theater use that Pacific has estimated.[62] Second, even if this threshold requirement were fully satisfied, it is not at all apparent why *real-time* transmission of films is required. If a theater were to invest the capital to acquire the video projection equipment, it could just as easily use distribution media such as videotape or laser disk for repetitive exhibitions of the same film rather than pay for a "live" feed over Pacific's fiber network. The local storage media could be delivered to the theater by courier or even the US mail for a lot less than the cost of deploying and utilizing broadband fiber. If this use of a LEC broadband infrastructure is all that anyone can think of, then we may well be talking about a technology in search of a use.

More generally, the LECs' vision of a need for *real-time* broadband distribution may well be seriously overblown. While an on-line transport and distribution network can provide widespread access to massive amounts of data, it must compete with alternative technologies, such as low-cost local storage media such as CD-ROMs. A single CD-ROM disk, which can be replicated in quantities for less than $1 (one dollar) per copy, is capable of storing in excess of one-half billion bytes of data. By way of example, the entire 840-volume F.Supp. series of Federal court decisions has been published on 12 CD-ROM disks.[63] Only volatile (as distinct from "static") data bases will require on-line access, non-volatile data can often be distributed at far lower cost than via real-time telecommunications, with little or no diminution in its value.[64]

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61. *Id.*

62. *Id.*

63. The purchase price of this series, $6,000, is obviously far greater than its modest $12 replication cost. However, from the perspective of the *publisher*, it is that replication cost that will ultimately dictate how the database is to be distributed. CD-ROM is obviously a lot less expensive than printed volumes, and is likely also far less costly than real-time telecommunications distribution.

64. Some have suggested that on-line distribution of data is necessary as a means for *metering* usage thereof in order to charge for access. However, significant advances in encryption technology now make it possible for such metering to be accomplished in data bases that are stored at the customer's site. For example, Apple Computer, Inc. recently sent out a mass mailing of a free *Software Dispatch CD-ROM* containing demonstrations of some 85 proprietary software products, along with the encrypted programs themselves having a combined retail value in excess of $6,800. If a customer wished to purchase one or more of these products after viewing

(continued...)

Given the lack of real financial risk faced by LECs when deploying new technologies, it is hardly surprising that their demand forecasts for advanced services have been severely over optimistic in the past. A comparison of the forecast and actual revenues for new network services of New England Telephone, for example, shows that more than half of its new offerings realized 20% or less of predicted revenues during their first several years of availability (see Table 5). Pacific Bell, which last year announced with great fanfare that it was spending more than $1-billion to complete the digitization of all of its California central offices[65] (having previously spent 3 times that much to deploy digital switches in the state), has just projected annual revenues from its basic rate ISDN service at only $4.5-million.[66]

The risks associated with large-scale investments in an advanced information infrastructure prior to credible evidence of sufficient, sustained demand have been underscored by the recent collapse of the proposed mergers between several of the nation's leading cable television companies and regional Bell holding companies.[67]

Clearly, this evidence confirms that condition (1) does not apply to the emerging information infrastructure, and that the "natural monopoly" approach consistent with condition (1) is neither required nor feasible for development of a viable national information infrastructure.

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64. (...continued)
the demonstration, he/she would simply call a designated 800 number, provide a credit card and the CD-ROM serial number to the agent, and receive a description key for each selected product, with the applicable charges appearing on the next monthly credit card bill.

65. See, *New York Times*, January 26, 1993, at 3, C-3.

66. Pacific Bell Advice Letters Nos. 16469, February 19, 1993; 16955, March 28, 1994; and 16836, November 17, 1993.

67. See, e.g., "Southwestern Bell and Cox Cancel Venture," *Wall Street Journal*, April 6, 1994, at A3.

Table 5

Comparison of Forecast vs. Actual Revenues
New England Telephone's "New" Services (1990 Data)

Service	Date Introduced	Forecast Revenues	Actual Revenues	$ Variance	% of Forecast
INFOPATH Pkt Swtchg	11/29/87	$7,304,000	$350,000	($6,954,000)	4.8%
SUPERPATH Multiplexing*	01/21/88	$139,000	$17,500	($121,500)	12.6%
INTELLIPATH II**	01/29/88	$2,246,100	$925,000	($1,321,100)	41.2%
INTELLIDIAL	07/19/88	$3,034,801	$710,000	($2,324,801)	23.4%
PULSENET	12/15/88	$196,200	$50,000	($146,200)	25.5%
CO-LAN	12/18/88	$42,000	0	($42,000)	0.0%
Custom Announcement	12/22/88	$375,540	$35,964	($339,576)	9.6%
INFO-LOOK***	06/20/89	$1,140,480	$64,000	($1,076,480)	5.6%
DOV PATH	07/27/89	$599,167	$13,700	($585,467)	2.3%
DIGIPATH	07/27/89	$12,580,948	$11,868,000	($712,948)	94.3%
SUPERPATH Frac. T-1	07/27/89	$300,800	$91,500	($209,300)	30.4%
RINGMATE	07/30/89	$690,000	$225,000	($465,000)	32.6%
Information Delivery	09/08/89	$4,027,009	$470,456	($3,556,553)	11.7%
TOTALS		$32,676,045	$14,821,120	($17,854,925)	45.4%
TOTALS (without DIGIPATH)		$20,095,097	$2,953,120	($17,141,977)	14.7%

* Data shown are for New England Telephone - Massachusetts.
** The monthly rate was reduced in 1989 from $350 to $175.
*** Service was withdrawn.

NOTE: Excludes 800 VALUFLEX which is essentially a repackaging of an existing service; also excluded are "new" services for which no forecast was provided.

SOURCE: Massachusetts Docket DPU-100, NET Response to DPU-1-12

There is no evidence that the national information infrastructure suffers from a lack of private risk capital.

With regard to condition (2), i.e., the prospect that sufficient private risk capital will not materialize to fund the national information infrastructure, the accelerating pace of investments in information technology and related markets appears to strongly contradict this possibility. In its annual review of the nation's industrial economy, the U.S. Department of Commerce has specifically recognized this trend in the electronic information services market:

> Electronic information services grew 16 percent in 1993 to an estimated $13.6-billion, slightly faster than the previous year's 15 percent increase. The industry continues to attract new suppliers and customers. Investors' keen interest is shown by increasing attendance at the Information Industry Association's annual investor conference, from 150 in 1992 to 600 in 1993.[68]

The Commerce Department also forecasts average annual growth in electronic information services in excess of 15% for the next five years, and cites the "explosive growth" in the quantity of on-line services over the past 15 years.[69] Strong private investment is also occurring in other areas that will contribute to the development of the national information infrastructure. The major CAPs, such as MFS Communications, Teleport, and Local Telecommunication, Inc. "are buying switches to provide Centrex, integrated service digital network offerings, signaling system 7 and metropolitan area networking that compete directly with LECs."[70] MFS Communications, for example, recently expanded its networks in six major cities and northern New Jersey, and according to its President and Chief Operating Officer, "[o]ur plan is to expand to 75 markets over the next three to five years..[o]f those, around 65 will be domestic and 10 will be international."[71] Microsoft is reported to be spending $100-million a year on research and development aimed at "build[ing] an interactive

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68. *US Industrial Outlook 1994*, US Department of Commerce (January 1994), at 25-2. The previous year's version opined that "[t]he long term outlook for the electronic information services industry has never been better, despite challenged faced by the industry. ... Investor confidence in information services is high." *US Industrial Outlook 1993*, at 25-3.

69. *Id.*, at 25-2, 25-3.

70. *Telephony*, January 17, 1994, at 32.

71. "MFS expands in the U.S. and beyond," *Telephony*, February 21, 1994, at 9 and 16.

TV franchise that will match its dominant position in personal computers."[72] Motorola continues to actively pursue development of the ambitious "Iridium" system, which is intended to provide a range of advanced personal communications services through a network of low-earth orbit satellites by 1998. The trade press notes that "[t]he $3.4-billion Iridium project...has drawn binding investor commitments and initial cash payments."[73] At this stage, there is no evidence to suggest that an infusion of government money — or indeed, funds supplied by captive customers of the price cap LECs — is needed in order to spur development in this sector.

Nevertheless, it may be argued (and undoubtedly *will* be argued by proponents of a linkage of price caps to infrastructure development) that development of an advanced information infrastructure will proceed more slowly than is optimal for the nation as a whole without affirmative government action. Even if private risk capital were being infused into the emerging information sector, proactive government intervention — such as through manipulation of the price cap plan — to stimulate additional investments might be warranted, if the net benefits to society of the investment could be reasonably anticipated to exceed the costs. In that case, however, the correct approach is to have the investments backed by the government — or by ratepayers of existing monopoly services — to be applied on an incremental basis only in those areas where the marketplace is unable to satisfy demand directly. For example, if the Commission determines that additional stimulus is needed to ensure universality of advanced telecommunications facilities (e.g., access by schools, hospitals, and other agencies, but only where it is not forthcoming from the private sector), targeted programs should be devised for that purpose alone, filling the "gap" between the market allocation and the desired outcome. Moreover, such initiatives should be even-handed with respect to the supplier, rather than giving preference or sole responsibility/opportunity to the LECs; for example, public funds to build advanced facilities to link schools, high-cost rural areas, etc. to the national network should be allocated via a bidding system for that is open to LECs, CATV operators, CAPS, and any other qualified providers.

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72. *Wall Street Journal*, March 21, 1994, at R16.

73. "Scientific-Atlanta wins Iridium deal," *Telephony*, February 7, 1994, at 10.

Baseline Issue 2: Composition of Baskets and Bands

Baseline Issue 2: Whether the rules relating to the LEC price cap baskets and bands should be revised. Specifically, commenters should address whether current or revised price cap baskets and bands would reflect expected levels of competition for LEC interstate services, or other relevant common characteristics. For example, we request information and comment on whether differences in pricing behavior within and among baskets evidences different levels of competition.

There is presently no need to change the rules relating to the LEC price cap baskets and bands.

It is not necessary to change the rules relating to the LEC price cap baskets and bands at the present time. The existing basket and band structure, combined with the other price cap features, offer sufficient pricing flexibility to allow the local carriers to adapt their pricing to the nascent competition that they face. The nature and dynamics of the access market are such that the limited filing and cost support requirements that exist under price caps today do not hamper the ability of the LECs to "compete" in any substantial manner. Further streamlining is clearly not warranted at this time.[74] Today, the only category of service that is even theoretically competitive is interexchange services: Those services are already segregated into their own basket, and that basket is already subject to slightly different treatment than the others.[75]

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74. We anticipate that the LECs will point to the long lead time that has been encountered between the time that tariffs for certain service offerings were filed, and the time that final rates were approved. In virtually all instances, however, the delay is directly attributable to a failure on the part of the carriers to adequately support the prices they have been proposing. The present investigation of the 800 database tariffs presents a graphic example. The Commission has been attempting to evaluate the costs associated with the provision of database service for well over a year now, yet the carriers still have not provided data of sufficient detail to allow proper evaluation of the proposed prices.

75. The interexchange basket contains *interstate intraLATA* toll services and *Corridor* exception area interstate toll services. As the Commission has recently recognized in its *North American Numbering Plan* NPRM, equal access (1+ dialing) is not available to interexchange carriers for interstate intraLATA "1+" toll traffic. The Commission has, for the first time, raised the issue of requiring the LECs to offer access to interexchange carriers on a 1+ basis for interstate, intraLATA traffic. See, *Notice of Proposed Rulemaking*, CC Docket 92-237, Phases One and Two, April 4, 1994 at paragraph 58.

While it may be appropriate to permit more streamlined and flexible regulation of LEC services when changes justify such revisions, there is no question but that such revisions are not justified at this time. When necessary, pricing flexibility can be granted through methods other than basket revisions. The zone density pricing plan approved as part of CC Docket 91-141[76] is an example of one such alternative — other plans could also be devised. The existing rules also allow LECs to propose "below band" prices. Interestingly, the vast majority of the local carriers have yet to take advantage of the full level of pricing flexibility available under the Commission's rules. There has been no demonstration that the full range of pricing flexibility that is already available has been exhausted, or that other less extreme measures than revision of the baskets could not achieve any "flexibility" requirements that might arise over the next several years.[77]

Also, as posited in the NPRM, it is likely that revisions to the basket and band structure of *any type* will necessitate revisions to other portions of the price cap plans. Since there has been no demonstration that additional pricing flexibility beyond that encompassed by existing rules in necessary, the Commission should avoid the complexities that would be inherent in revisions to the existing basket structure.

Restructuring baskets based upon levels of competition

The NPRM raises the possibility of revising the baskets to a structure similar to the AT&T model, in which services were assigned to baskets "largely on the basis of the perceived level of competition for the services".[78] Should the Commission determine that it is appropriate to revise the existing basket and band structure, this *concept* of constructing baskets based upon level of competition is the correct approach. The actual *method* used for AT&T is, however, inappropriate.

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76. *Op. Cit.*, at footnote 6.

77. The *NPRM* specifically requests comments upon whether differences in pricing behavior within and among baskets evidences different levels of competition. In theory one would expect that effect but it is not possible to determine to what extent differences in pricing among baskets represents other issues as well. For example, assuming that prices for the voice grade service category within the dedicated transport basket exhibit different behavior than prices for high capacity digital services in that basket, there is no way to determine whether that effect is the result of greater competition for high capacity digital services, or the result of a desire on the part of the LECs to migrate customers out of analog transport facilities and into digital facilities. Therefore, while pricing behavior can be an indicator of the extent of competition in various market segments, it is important not to overlook the fact that other strategic LEC goals also impact price setting.

78. *NPRM*, para. 37.

The AT&T structure is inappropriate for a number of reasons. First, the interexchange market and the services to which AT&T price cap baskets were applied was different in structure than that for LEC access services. In the AT&T situation, wide *classes* of services, distinguished in large part by the customers they were marketed to, were subject to differing levels of competition. In the LEC access market, the level of competition to which a LEC service may ultimately be subject is a function of technology and network characteristics much more than customer class. This is a critical difference.

A better system for LEC access services would be to affirmatively design baskets with specific "competitive status" in mind, and assign services to those baskets (and move services between baskets) as conditions warrant. With baskets based upon competitive classifications appropriate levels of streamlining and flexibility could be granted to each basket as warranted and services could be moved between and among the baskets. LECs would, of course, be required to file data with the Commission demonstrating the appropriateness of moving a service out of one basket and into the next, and interested parties should be able to comment upon the evidence provided. The existing "service category" structure could (and should) continue to be used within the broad new basket structure. Baskets designed to reflect the "competitive status" of individual services would continue to carry out (or at least not hamper) the Commission's original goals for the price cap plan: i.e., increased efficiency, reasonable non-discriminatory rates, and the minimal regulation necessary.

Baseline Issue 3: Changes in Productivity Factors or Rate Levels

Baseline Issue 3a: Whether the productivity factor used to compute the LEC price cap indices should be changed; in addition, or in the alternative, whether a one-time change in the LEC's price cap index should be required. If a rate reduction were required, commenters should discuss how such a reduction should be distributed among price cap baskets and service categories. As a further alternative, whether the Commission should adopt a mechanism which would adjust the plan to reflect changes in interest rates. Commenters should discuss how such a mechanism would operate, including, for example, what deviations in interest rates would trigger the adjustment mechanism. Commenters should address how the option they advocate would preserve or improve price cap incentives and assure just and reasonable rates.

Baseline Issue 3c: If the productivity factor should be changed, what method should the Commission use to determine a revised and reasonable productivity factor?

The Commission must increase the X factor in the LEC price cap formula: Otherwise, the productivity gains achieved under the price cap system will not be flowed through to ratepayers, resulting in windfall gains in the LEC's earning.

The current LEC price cap program is based on the rate of US inflation (represented by the fixed weight Gross Domestic Product Price Index, the "GDP-PI") minus a productivity offset (or "X factor") of 3.3%. A 4.3% productivity offset is offered as an option for LECs who elect slightly different sharing parameters.[79] Experience under price cap regulation at both the federal and state level over the past several years has amply demonstrated that the 3.3% X factor that was adopted by the Commission is unreasonably low and unnecessarily generous to the LECs, and that as such it has produced excessive rate levels that far exceed those which the "competitive result" goal of economic regulation would dictate. In this first review of the FCC's price cap regulation system, the applicable X factor should be significantly increased.

79. *NPRM*, para. 43.

The purpose of the X factor was to provide an adjustment to general price level changes (as reflected in the GDP-PI or GNP-PI) to recognize "normal" productivity and other conditions particular to local telephone utilities. There are at least three major components of the X factor calculation — (1) the LEC telecommunications input price growth rate, (2) the LEC telecommunications total factor productivity growth rate, and (3) the consumer productivity dividend which is sometimes referred to as a "stretch factor." In this section of the report, we discuss the extensive evidence regarding the input price issue and the total factor productivity growth rate, as well as the economic logic underlying the stretch factor. The results of our analysis of each of these issues provides sound economic support for increasing the X factor at this time. This conclusion is well supported by the quantitative results cited by the Commission:

> All the price cap LECs have experienced higher earnings on average under price cap than in earlier periods. Their rate of return has increased from 11.25 percent at the start of price caps, to an average of 12.25 percent in 1992.[80] Not only have the LECs achieved relatively higher earnings under price caps, but they also have enjoyed sharply declining interest rates, which have fallen to their lowest levels in many years.[81]

Our results regarding each of three components of the X factor are summarized in this section of the report. More detailed analyses of issues 1 and 2 are then presented in the two technical sections following this summary.

1. Calculation of the growth rate of LEC Input prices relative to the growth rate of national inflation

The current LEC Price Cap Program is premised upon a measure of US inflation (represented by GNP-PI) *minus* a "productivity offset" of 3.3%.[82] The GNP-PI and GDP-PI are indices of *output prices*, which are not necessarily the same as the *input prices* actually paid by LECs for the labor, materials and capital equipment they employ in producing their

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80. According to the FCC, "[f]or the BOCs, 1992 rates of return ranged from a low of 11.41 percent for Bell Atlantic to a high of 13.32 percent for NYNEX, while GTE earned 11.26 percent, Rochester 12 percent, and United 12.81 percent." *Id.*, at para. 44.

81. *Id.*, at para. 44.

82. *Id.*, at para. 43.